National Atmospheric Deposition Program (NADP)/ National Trends Network (NTN):

What it is and How to Operate a Site

We welcome your participation in the 200-site precipitation chemistry network, known as the National Trends Network (NTN), which is part of the National Atmospheric Deposition Program (NADP). This is one of the longest-running environmental monitoring networks in the United States, with some sites having been continuously operating since 1978.

Find attached two of the NADP products: (1) an information brochure on the network called "Inside Rain" and the standard map product publication for 1996. Additional information and current site data and maps can be viewed on the NADP web site at http://nadp.sws.uiuc.edu.

NTN: What Is It?

- NTN is a 200-site network located in rural sites where rain and snow are collected weekly.

- Precipitation samples are analyzed by the Central Analytical Laboratory (CAL) at the Illinois State Water Survey for constituents, including nitrate, sulfate, pH, and other major ions.

- Field and lab quality assurance programs are included in the cost of the network to insure good quality data that are comparable among sites.

- Data are presented in both tabular and graphical format on the web and in special publications within ninety days in draft form.

- Sponsors include federal and state agencies, universities, public utilities and industry groups. There are thirty-five sites in National Park Service units, which provide data for education, research, resource management, and air regulatory programs.

NTN Sites: Who is responsible?

- The Air Resources Division of the National Park Service (NPS-ARD) pays the annual operations costs for the sponsored sites (about $7000). This amount covers chemical analysis of samples, consumable supplies, and program coordination costs. This money is paid to the Illinois State Water Survey through a cooperative agreement with the U.S. Department of Agriculture.

- The NPS-ARD covers costs for start-up, including the Aerochem Metrics precipitation collectors, Belfort recording rain gage, pH meter, specific conductance meter/electrode, and weighing balance. We also fund the installation of the site, including secure electrical service.

- The Illinois State Water Survey in Champaign-Urbana is the site of both the Program Office and the CAL. These groups provide technical support, training for field operators, chemical analysis,

data analysis and products, and special reports. The Program Office sponsors annual technical meetings and semi-annual organizational meetings to allow for input from the sponsoring agencies.

- The Environmental Protection Agency and the U.S. Geological Survey-Water Resources Division provide funding and personnel for QA/QC and field audit programs.

- The field sites (park units) provide a secure location for the equipment, which meet the NTN siting requirements. They also provide an Site Operator who can visit the site on Tuesday mornings to remove the bucket, perform simple laboratory procedures, and ship the sample to the CAL. The Site Operators will be called on periodically to perform some QA checks and to do "trouble-shooting" on equipment.

Why do we need these sites?

- This is the only network in the United States that can be used to determine spatial and temporal trends in the chemistry of precipitation. These data allow agencies to understand the effects of air pollution and climate variations on the amount of man-made chemicals that may affect resources.

- This monitoring site and the data generated are valuable as teaching tools for interpretation programs.

- In concert with the dry deposition measurements being made at many of the park sites, we will be able to estimate total loading of chemicals, such as nitrogen, sulfur and acids to these sites.

- State and federal regulatory agencies can use these data for modeling and regulating air pollutants that are transported into parks.

- Researchers can use this information in exploring amount of chemical inputs that may be affecting protected natural resources, such as fresh waters, estuarine systems, soils, native vegetation, and other biological processes and populations.

NTN Status: Current and Future

The NTN operates in 46 states, has 200 active sites, and extends from Puerto Rico and the Virgin Islands in the east to Alaska in the west. Two of the network sites are duplicate sites, operating two precipitation collectors and gages. Duplicate sampling is one component of the network quality assurance program.

NTN data are necessary to evaluate the status and effectiveness of the acid deposition control program implemented under the most recent amendments of the Clean Air Act. The Act seeks to reduce the adverse effects of acid deposition through reductions in annual emissions of sulfur dioxide and nitrogen oxides. The first round of sulfur dioxide emission reductions occurred on January 1,

1995. According to the Act, a second round of reductions must occur before January 1, 2000, bringing the total sulfur dioxide reductions to 10 million tons from 1980 emission levels. With nearly 200 sites measuring precipitation chemistry in the major ecoregions of the United States, the NTN is well-positioned to provide the data necessary to assess the location and magnitude of changes in precipitation chemistry resulting from these emissions reductions.

NTN data are being used to:

- assess the effect of sulfur dioxide emissions reductions on sulfate in precipitation.
- estimate the amount and importance of atmospheric inorganic nitrogen deposited to coastal waters in which nutrient enrichment degrades the water quality.
- explore the causes of the downward trend in base cation concentrations in precipitation and the effect this may have on the fertility of some acidic forest soils.
- continue to monitor how acidic lakes and forests respond to the changing chemistry of precipitation especially nitrate, ammonium, and sulfate, and to
- examine the relationship between pollutant sources, air quality, and precipitation quality.

Support for NTN comes from a diverse group of sponsors, ranging from federal agencies that fund 10s of sites to a high school that provides a site location. Sponsors include: 1 high school, the U.S. Military Academy, the Kennedy Space Center, 2 Native American tribal organizations, 3 agencies of the Canadian government, 3 U.S. national laboratories, 4 city governments, 9 private companies, 9 Forest Experiment Stations, 17 state agencies, 21 universities, 43 State Agricultural Experiment Stations, the U.S. Geological Survey; the Cooperative State Research, Education, and Extension Service; the National Oceanic and Atmospheric Administration; the Environmental Protection Agency; the National Park Service; the U.S. Forest Service; the Bureau of Land Management; the U.S. Fish & Wildlife Service; and the Tennessee Valley Authority.

NTN sponsors and the dedication of the people who operate sites continue to make NTN one of the most successful cooperative programs in the United States. Scientists have said in review of the NTN, "The monitoring program is perhaps the most significant long-term, continuous, and comprehensive sampling and analysis program to be undertaken in the environmental sciences."

Summary of Responsibilities for Operating an NTN Site

Standard Site Equipment

- Aerochem Metrics precipitation collector
- Belfort recording rain gage with event recorder
- pH meter
- pH electrode*
- specific conductance meter and electrode
- electrode filling solution*
- vials *
- pH 4 and 7 buffer solutions*
- conductance standard solution*

- QC solution for pH and conductivity checks*
- balance
- Field Observer Report Forms*
- Gloves*
- rain gage charts, ink, and dashpot fluid*
- replacement parts*
- wash bottles
- laboratory wipes
- parafilm
- extra beakers

* denotes items provided by the CAL, others by NPS.

Standard Sampling Period

The sampling period is the interval of time between sample bucket installation and removal. Standard sampling periods are defined as follows:

- Samples accumulate for one week, Tuesday to Tuesday.
- Buckets are removed and replaced at approximately 9 a.m. (0900 local time) each Tuesday. If it is raining or snowing, this step occurs after the precipitation stops or as dictated by the Site Operator's travel schedule.
- In order to be valid for inclusion in annual data summaries, each sample must cover from 6 to 8 days (144 to 192 hours).
- Buckets are replaced weekly, processed, and sent to the CAL even if no precipitation was collected. These buckets may be used for "field blank" procedures in which they are checked for the same ions as normal samples to assess the impact of gases and particles on the bucket when the collector did not accumulate a sample.

Site Operator Responsibilities

The Site Operator has primary responsibility for operation of the monitoring equipment, maintenance of the site, and weekly collection and submission of precipitation samples and documentation. Site Operator duties include:

- Travel to and inspect the site.
- Retrieve the weekly precipitation sample and rain gage chart.
- Insertion of a clean wet bucket and new rain gage chart.
- Perform routine inspection, maintenance, and repairs on site.
- Conduct pH and specific conductance measurements on the precipitation sample.
- Read, complete, and interpret the weekly Field Observer Report Form and rain gage chart associated with each sample.
- Assure that the sample and data are shipped to the CAL within 48 hours of removal.
- Participate with the CAL and others to define and assure data quality.

Site Operators generally spend approximately 2 hours performing weekly duties, excluding travel time to the site. The video "Every Tuesday Morning" (1994 edition) addresses all site operations and should be kept on site for use when necessary.

National Park Service Responsibilities

The NPS helps to ensure that sites are equipped properly, that equipment is installed in compliance with network siting criteria, and that standard site operational procedures are followed. The NPS shall designate a Site Supervisor who is responsible for overseeing and assisting in site operations and for ensuring that protocols are followed. A Site Supervisor may be on site or remote; however, the tasks remain essentially the same. NPS responsibilities include:

- Arrange for the provision of human and financial resources for site installation and operations (including lease arrangements for the site, travel to the site, site security, electricity for site operations or appropriate solar/battery power, repair/replacement of pH meter and conductivity meter/cell as necessary, initial training of the Site Operator, and cost of sending samples to the CAL).
- Provide and maintain field sampling equipment (Aerochem Metrics precipitation collector and Belfort recording rain gage with event recorder) and laboratory equipment (pH meter, specific conductance meter/cell, and balance).
- Provide assistance to the Site Operator, as needed, when operational or siting problems arise (includes resources necessary to maintain site in compliance with site installation criteria).
- Review data reports issued by the CAL and the Program Office.

Technical Support

This includes technical assistance in locating and installing sites and maintaining them in good condition, troubleshooting operational problems, and providing chemical, analytical, site support, and data management services.

Central Analytical Laboratory (CAL)

The Central Analytical Laboratory, located at the Illinois State Water Survey (ISWS), provides chemical, analytical, site support, and data validation and reporting services. This includes the provision of information on procedures and certain supplies necessary for site operation. On receipt of the weekly samples, the CAL mails each site a clean field bucket, lid, and one-liter sample bottle, along with any expendable supplies requested on the Field Observer Report Form (FORF).

At the CAL, all data from each FORF are entered, verified, and maintained in a database while each sample undergoes laboratory analysis. Each month the CAL combines the field information and the laboratory analyses and provides the Site Operator and Site Supervisor with preliminary data reports. In addition the CAL provides full-time assistance related to operational or procedural problems via telephone, FAX, or e-mail to site personnel. After the data have been quality assured, the CAL issues a final data report to the NTN Program Office and archives portions of each sample for further use.

Finally, the CAL conducts annual training courses for Site Operators.

Program Office

The Program Office, located at the ISWS, provides management and coordination support for the program. It provides data users, and administrators with information about siting, equipment installation, and budgeting. It also manages the NED and provides for the repair and refurbishment of NED equipment. The Program Office provides the user community with final quality assured data and all network documentation. The Program Office operates and maintains the NADP web site (http://nadp.sws.uiuc.edu) and issues data summaries, reports, and brochures.

External Audit and Performance Review Programs

Two federal agencies provide external quality assurance evaluations of field site and CAL operations. The Environmental Protection Agency and the U.S. Geological Survey conduct performance reviews and evaluations and provide sites, the CAL, and the Program Office with information about completeness, accuracy, representativeness, and comparability of NTN data and methods. Both agencies issue periodic reports that are available from each agency or through the Program Office.